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Threshold Effects of ICT Access and Usage in Burkinabe and Ghanaian Households

Forthcoming: Information Technology for Development

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Threshold Effects of ICT Access and Usage in Burkinabe and Ghanaian Households

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Abstract

Information and communication technology (ICT) has a crucial role in the individual, businesses and cooperative lives of citizens. Many studies on ICT access tend to concentrate on the supply side of improving access to ICTs; however, limited efforts have been made to examine the households' demand side. Thus, this study contributes to the extant literature by investigating the demand side of ICT access by households. It also examines the socioeconomic characteristics that affect the households' access and usage of ICTs, which create a somewhat digital divide between 'ICT have' and 'have not' in Burkina Faso and Ghana. It employs Demographic and Health Survey (DHS) data for both Burkina Faso and Ghana 2014 in achieving its objectives. The results, among others, underscore different threshold effects in access to ICTs Burkinabe and Ghanaian households. Thus, to enhance the households' ICT access, and consequently, usage the features of the households should be taken into consideration when developing ICT access policies.

Keywords: Burkina Faso, Ghana, Households, ICT access and Usage, Threshold effect.
JEL Codes: O14; R22

1. Introduction

Generally, information and communication technologies (ICTs) are the equipment of modern usage that has gained interest and used by many persons across the globe. ICTs, as regarded by the World Bank (2009), are hardware, software, networks and media for collection, storage, processing, transmission and presentation of information in the formats of voice, data, text, and images. These devices or equipment cover any product that can store, retrieve, manipulate, transmit or receive information electronically in a digital form. They include computers, internet, radios, mobile phones, digital cameras, geographic information systems (GIS), and tracking mechanisms that can be used to capture, read and store data or information. The Internet is a worldwide system of computer networks that provides information and services such as online transactions, messaging (notably emails and files transfers), e-business, and online education (McCormick & Onjala, 2007; Karakara & Osabuohien, 2020).

Recent increases in ICT affordability, accessibility, and adaptability have enabled its use in many sectors, including agriculture. Small ICT devices (e.g., multifunctional mobile phones and nanotechnology for food safety), infrastructure (e.g., radio, mobile telecommunications networks and cloud computing facilities), applications (e.g., those that transfer money or track an item moving through a global supply chain), have proliferated across the globe (Anser *et al.,* 2021; Asongu & Nwachukwu, 2016; Ejemeyovwi & Osabuohien, 2020).The 1998 World Development Report from the World Bank stressed the role of information, knowledge, and ICTs in achieving development. The creation of the Digital Opportunities Taskforce by the then G8 in 2000, and the World Summits on the Information Society (WSIS) in 2003 (Geneva) and 2005 (Tunis), all gave impetus to the importance of ICTs in development.

ICTs can be used to achieve significant issues like economic equality, social mobility, democracy and economic growth (Baliamoune-Lutz, 2003; Vincze, 2016). It can be used to distribute locally relevant information, help the disadvantaged groups, to promote local entrepreneurship, improving poor people's health, strengthen education at ease (Karakara & Osabuohien, 2019a), promoting trade and e-commerce, supporting good governance, enriching culture, supporting agriculture, creating employment, and reinforce social mobility. They can lead to reducing poverty (Deen-Swarray, 2016; Lashgarara *et al.,* 2009; Okafor, Imhonopi &

Urim,2011; Schmidt & Stork, 2008) and human progress (Lee *et al.*, 2017). Importance of ICTs in the development process and access to ICTs was made one of the targets of the Millennium Development Goals (MDG 8 specifically), which emphasises the benefits of new technologies, especially ICTs in the fight against poverty.

An upsurge of ICTs deployment in Africa has led to enormous growth and development being achieved. ICTs adoption and usage in Africa, especially mobile phones, have reached almost 650 million as at 2012, which is more than the rate in the USA and the EU (Yonazi, Kelly & Blackman, 2012). The mobile phone has now grown into an indispensable engine of growth for economic activities throughout Africa. According to "The Mobile Economy Africa 2016" report, the overall adoption rate for mobile phones in Africa relative to the population had reached 46% by 2015 and expected to grow by approximately 6% yearly. In the same 2015, the added value created by the mobile economy accounted for 6.7% of the overall GDP of Africa (Naito, 2018). The first Transform Africa Summit (TAS) held in Kigali, Rwanda in 2013, saw seven heads of state in Africa shared leadership in establishing Smart Africa, as a regional initiative to accelerate social and economic development in Africa through ICTs.

Some studies have examined the factors that influence the individual as well as household adoption of ICTs in Africa. Bagchi and Udo (2007) concluded that economic development, education, and infrastructures determine ICT adoption. The cultural settings of society are deemed to be linked to ICT adoption (Zhao, Kim, Suh, & Du, 2008), and Corrales and Westhoff (2006) found the political system of a country to have implications on ICT adoption and usage. It is acknowledged that high incomes earners with good education and high skills are more likely to have access to ICTs. They are also capable of using ICTs, benefit from ICTs usage, and to be in political participation by ICTs than people who are not endowed with much of economic, political, cultural capital, geographical location, and gender (Kamal & Qureshi, 2009; Puri, 2006). Also, Asongu and Odhiambo (2020a) acknowledged that enhancing ICT beyond certain thresholds is necessary for ICT to mitigate inequality and promote gender economic participation. Asongu and Odhiambo (2017) indicated that increasing mobile banking dynamics to certain thresholds would increase (decrease) quality of growth (inequality) in quantiles at the high-end of inclusive development distributions. In another study, Asongu and Odhiambo

(2020b) concluded that both internet penetration and mobile phone penetration modulate FDI to induce overall positive net effects on all three economic growth dynamics (GDP growth, real GDP and GDP per capita). These three studies (Asongu and Odhiambo 2017; 2020a; 2020b) explored thresholds of ICT dynamics. However, the issue that was not clearly spelt outwas: what point (margin) do individuals adopt or abandon ICT equipment?

Some researchers (e.g., Barrantes *et al.,* 2007; Schmidt &Stork, 2008; Gilwald *et al.,* 2010; Al-Hassan *et al.,* 2013) have used probability models to study how socioeconomic characteristics have helped in determining individuals' and households' adoption of ICTs. These studies did not examine the margin or threshold at which a particular ICT is adopted or abandoned. This study also extends the frontier of knowledge in this area by exploring the following questions: at what age do individuals abandon the use of ICT equipment? Are males attuned to ICTs more than their female counterparts? Do socioeconomic characteristics differ in determining the adoption and use of ICTs in Burkina Faso and Ghana? Thus, this study differs from extant studies by estimating the threshold at which specific ICT gadget is adopted or abandoned by individuals. It applies the marginal effects at representative values of a binary logistic regression and the Lowess smoothing techniques to estimate the threshold effects of ICT adoption and usage. A brief literature review on ICT follows this introduction; the third section presents a background to the countries studied and the method of analysis are captured in fourth section while the fifth discusses the results and the last section concludes.

2. Insights from Empirical Literature and Theoretical Underpinnings

2.1 Empirical Literature

There has been lots of established research on an individual as well as household adoption of ICTs within the information system literature. Most studies (Lee *et al*., 2017) on this argued for the factors that influence an individual to adopt ICT and the benefits of adopting such ICTs. Some studies concluded that individual characteristics such as perceived usefulness, personal innovations, prior experience, image and enjoyment with innovation strongly influence an individual's decision to adopt a given technology (Venkatesh & Davis 2000; Lewis *et al.,* 2003). Mathieson (1991) and Yi, Jackson and Probst (2006) summarised that human and social factors could play a role in the adoption of technology using the TPB model. Shih and Fang (2004)

studied the adoption of internet banking by the use of TPB as well as Decomposed TPB. They found that subjective norms have a significant influence on behavioural intention to use technology. Peansupap and Walker (2005) separate individual, environment, management and technology factors as determinants contributing to information and communications technology (ICT) adoption. Individual factors include, e.g., feelings and perceived usefulness, environment factors include help being available and a supportive and communicative work environment, management factors include support from managers and technology factors include frustration with ICT use. While Asongu and Odhiambo (2020a) showed that enhancing ICT beyond certain thresholds is necessary for ICT to mitigate inequality in order to enhance gender economic participation.

Individuals, as well as household adoption of ICTs, has led to increased welfare, reduce poverty, increase literacy, political participation, and financial access (Osabuohien & Karakara, 2018). Economic growth is well measured by per capita income. Kayisire and Wei (2016) concluded that a strong economic foundation is indispensable in ICT adoption and utilization. Baliamoune-Lutz (2003) revealed that income is a significant determinant of ICT diffusion in developing countries because it shapes both ICT infrastructure (utilization of personal computers and Internet hosts) and ICT service usage (Internet access). Galperin and Mariscal (2007) concluded that the mobile phone is highly valued by the poor as a tool for strengthening social ties, security and employment opportunities: while low-income mobile users prefer prepaid services to post-paid. Mobile acquisition by the poor has an economic impact, which helps to reduce poverty. There are shreds of evidence that ICTs have helped to reduce poverty (Easterly & Levine, 1997; Roller & Waverman, 2001). Research on poor communities showed that telephone and radio are the most essential (direct access) ICT tools for changing the lives of the poor (Heeks, 1999). Radio is a useful device which carries useful information to the poor, mostly in the language that the poor understand best. A survey of 21,000 farmers enrolled in radio-backed farm forums in Zambia found that 90% found the programmes relevant and more than 50% credited the programmes and forum with increasing their crop yields (Harris, 2004; Sibalwa, 2000).

The Grameen Bank in Bangladesh, a village-based microfinance organisation, leases cellular mobile phones to successful members, which has delivered significant benefits to the poor. They

use the phones basically to exchange prices of agricultural products, business and health-related information. Information flow from these benefactors has resulted in better prices for outputs and inputs, easier job searches, reduced mortality rates for livestock and poultry. Also, in the financial inclusion arena, mobile banking service had a significant impact on the socioeconomic status of many, especially the poor (Adaba & Ayoung, 2017). The *MPESA* in Kenya, *MTN* Mobile Money in Ghana are some of these cases where many people can have access to finance (savings, loans), which they would otherwise not have done (Efobi *et al.,* 2014; Olokoyo, Adetiloye & Ikpefan, 2016; Osabuohien & Karakara, 2018).

The Kubatana Trust in Zimbabwe aims to strengthen the use of emails and internet strategies in local non-governmental organisations (NGOs) and Civil Society Organisations. Kubatana makes human rights and civic education information accessible to the general public from a centralized, electronic source and has become an essential means for disseminating information about political situation locally and internationally. The Mobile Technology for Community Health (MOTECH) initiative in Ghana uses mobile phones to increase access to and demand for health information and services among rural women, while also providing data on health service delivery and outcomes to the Ghana Health Service. MOTECH uses two different applications; Mobile Midwife and the Nurses Applications. Mobile Midwife provides pregnant women and their families with text (SMS) or voice messages that offer actionable information (including alerts and antenatal care reminders) about their pregnancy for each week of gestation in their language. The Nurses Application helps nurses working in rural health facilities to record and track the care provided to women and new-borns (Grameen Foundation Ghana,2013).

The age structure of the population relates directly to the labour force of a country and subsequently, the human resource of a country. A youthful age structure could be a driving force in the adoption and usage of ICTs. The age of an individual is ascertained to influence the adoption and use of ICTs. Al-Hassan *et al.,* (2013) evaluated the impact of the ICT based Market Information System (MIS) implemented and found that for a unit increase in age the likelihood of individual participating (accessing ICT) in the MIS will decrease by 0.5%. Gilwald *et al.,* (2010) concluded that increase in an individual age reduces the probability of knowledge and use of the internet and subsequently access and that age was found not significant for radio use, but

is significant and increase the likelihood of watching TV. Chabossou *et al.,* (2009) established that age likely impact positively on the probability to adopt mobile phones up to certain level and then decreases and Deen-Swarray (2016) concluded that age is negatively related to mobile phone adoption. Schmidt and Stork (2008) asserted in their study that age has a negative and significant coefficient; thus, the probability of an individual having e-skills declines with increasing age.

The educational level of the individuals in a country shows how skilled labour the country can harness for growth and development. Educational level is in no doubt that it influences the type of ICT an individual would adopt and use. Many studies have found the educational level of the individual to determine ICT adoption and usage. Al-Hassan *et al.* (2013) evaluated the impact of the ICT based Market Information System (MIS) implemented in the North-East of Ghana. They concluded that those individuals who have ever participated (ever had education on ICT) in similar projects have a 61% likelihood of participating in the MIS project. Chabossou *et al.* (2009) found the education of the individual to enhance mobile adoption. In a similar vein, Deen-Swarray (2016) asserted that individual ownership of a mobile phone is much higher among those with substantial levels of basic literacy (reading and writing) and that having basic literacy, English language literacy and e-skills literacy can increase the probability of phone ownership. The above is similar to Shaffril *et al.*,(2010) conclusion that those who are highly educated or have attended ICT training before use computers more than those not educated or have not attended ICT course before. Schmidt and Stork (2008) found that lack of skills is a prerequisite to benefiting from access to ICTs. A majority do not use computers because of lack of knowledge, and hence a strong positive and significant probability of higher e-skills can be attributed to having completed tertiary education. Also, Ronning and Grepperud (2006) said that 82% of those classified as skilled have internet access and 93% of those regarded as professional/managerial had access to the internet and that the young, unskilled, part-time employees are those who have the least access to the internet. Contrary, Bagchi and Udo (2007) found literacy rate to have a negative effect on telephone adoption in Africa and Baliamoune-Lutz (2003) assertion that education and literacy have no impact on the dissemination of Personal Computers (PC).

Rural nature of a place is described to be an underdeveloped society. Rural-urban divide (the place where individual leaves) has often been cited as one of the factors that militate against efforts to achieve universal access to ICTs by many countries. Most individuals in rural settings have limited access to ICTs than their urban counterparts. Chowdhury (2002) studied how public-private partnership in Peru and Business – NGO partnership in Bangladesh helped to achieve universal access service in telecom and concluded that access to telecommunication in rural areas under those regimes has increased. Being in a rural setting was found to be negatively related to mobile adoption by a study by Deen-Swarray (2016). Schmidt and Stork (2008) found rural/urban differentials to be relevant in possession of e-skills and subsequent adoption of ICTs in the countries studied except Botswana. ICTs (mobile phone & radio) are found to be the most effective tools in decreasing the rural nature of society and help bridge the gap between urban and rural areas affluence. Research on poor communities showed that telephone and radio are the most important (direct access) ICT tools for changing the lives of the poor (Heeks, 1999) and for countries to achieve efficiency there is the need to deploy ICTs in all areas including rural settings (Cecchini & Scott, 2003; Kayisire & Wei, 2016; Adaba & Ayoung, 2017) as Jack and Suri (2011), noted that the M-PESA in Kenya, for mobile phones, which have ubiquity regardless of whether they are located in urban and rural parts of the country, even at places which lack regular banking services, M-PESA serves as a substitute for bank accounts. Radio is a useful device which carries useful information to the poor, mostly in the language that the poor understand best.

2.2 Theoretical Underpinnings

There are several theories of the individuals as well as the societal adoption of technologies (ICTs) including the Diffusion of Innovations, Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM), amongst others. The most acknowledged one in the adoption of ICTs is the TAM which is most often the framework used in predicting information technology adoption (Paul, John & Pierre 2003). The TAM has been tested by many researchers with different samples at different times and found to be the valid and reliable way of explaining information system acceptance and use (Mathieson, 1991; Davis & Venkatesh, 1996). The TAM had two particular beliefs, perceived usefulness and

perceived ease of use, which are of primary importance for computer acceptance behaviour (Venkatesh & Davis, 2000).

Another theoretical underpinning if the Bass model, which proposes that the probability that an individual or firm will adopt new technology (ICTs) at a given point in time is a linear function of the total proportion of previous adopters as influenced by the forces of innovation and imitation (Bass, 1969). The Bass model has an equation as follows:

$$p(t) = p + qF(t) \qquad (1)$$

Where, P(t) is the probability of adoption; F(t) is the total proportion of previous adopters, P is coefficient of innovation (external influence), q is the coefficient of imitation (internal influence), and t is a given point in time. The coefficient of innovation, P, is the coefficient of external influence and represents the adoption of innovation and the coefficient of imitation, q, is coefficient of internal influence, thus, q, measures spread of innovation due to interpersonal sources of information or the individual socioeconomic characteristics. The innovation dimension of the Bass model captures the tendency to adopt an innovation that is influenced by external factors. In contrast, the imitation dimension captures the tendency to adopt a new technology that influenced by "social contagion" or adopting what other individuals have adopted.

Drawing on the TAM model, the Bass model and the works of Karakara & Osabuohien (2019b), this paper theoretical adds to them by looking at the threshold or margin of ICT adoption by individuals. As the TAM model argues that, individuals adopt ICTs based on two things; perceived benefit and perceived ease of use. Karakara & Osabuohien (2019b) extended this by adding socioeconomic variables and argue that these variables determine the adoption of ICTs by individuals' aside from the perceived benefit and perceived ease of use. Also, the Bass Model looks at the likelihood of an individual or firm adopting new technology (ICT) at a point in time. This study adds to knowledge by examining the threshold or margin at which a particular ICT is adopted or abandoned by individuals. We theoretically engaged the Bass Model for some reasons surmised herein. It allows for the prediction of future adoption behaviour from partial adoption data (Mahajan *et al*., 1990; Wright & Charlett, 1995). Also, it helps us to use the binary logistic regression in this study, which gives marginal effects at representative values to help estimate the

threshold effect of ICT adoption. Theoretically, many studies have used Bass model or otherwise for studying different economies (Ransbotham & Mitra, 2009), firms (Ntwoku *et al.*, 2017; Ghobakhloo & Tang, 2015; Daim & Suntharasaj, 2009) and cross country (Lee *et al.*, 2017) on developed economies, with scanty studies drawing on the Bass model to study individual adoption of ICTs, especially developing countries. This study is distinct from extant literature as it draws from the TAM model and the Bass model to study household as well as individual adoption of ICTs in a comparative study of two different economies (Burkina Faso & Ghana).The countries (Burkina Faso and Ghana) are chosen basically because: they are of different colonial orientations (French for Burkina Faso and British for Ghana). This difference in legal origin could affect their policies (ICT policies) as well as their general governance style. Thus, the countries could have different rate or threshold at which ICT is adopted or not.

From the preceding discourse, it is observed that studies have examined ICT access using socioeconomic variables but have had different conclusions. Mostly, income (wealth), urbanisation, and education have a positive influence on ICT adoption. Age was found to have positive by some studies and negative by other studies to influence ICT adoption. Thus, this present study extends the frontier of knowledge by looking at the demand side if ICTs and carried out empirical analysis using the case of Burkina Faso and Ghana. This study underscores the threshold levels at which an individual adopts or abandons a particular technology. Some studies agreed that older people are not attuned to technologies (ICTs), but at what age does one abandon the use of technology. Also, there have been conflicting opinions concerning whether men use innovation more than women; the study also investigates this to ascertain its validity.

3. Background on Burkina Faso and Ghana

This section gives a brief background of the selected countries with respect to their population, the economy and ICT levels.

3.1 Burkina Faso

Burkina Faso is a landlocked country in western Africa. The country is bordered by six nations: Benin, Cote d'Ivoire (Ivory Coast), Ghana, Male, Niger and Togo, all of them former French colonial territories, with the exception of Ghana (which was a British Colony). The country has a land area of 274,222 km² which is about half the size of France. The country was formerly called

Upper Volta until 1984 when it was named Burkina Faso. Burkina Faso has 13 administrative regions and 45 provinces with Ouagadougou as the capital city. The country is captured in green colour in Figure 1. The official language of the country is French and different indigenous languages are also spoken. The country has a population of 20.32million with GDP 15.99 billion USD (World Bank, 2019). However, the population was estimated to have reached 21,510,181 in 2020 (Institut National de la Statistique et de la Demographie, 2021). Real GDP growth is estimated at 6% for 2019 and projected to grow by around 6% in 2020 and 6.1% in 2021 (Africa Development Bank, 2020).

Figure 1 near here

There are three mobile operators in Burkina Faso: TELMOB (by National Office of Telecommunications), Orange Burkina Faso SA (by Orange Middle East and Africa) and TELECEL FASO SA (by Planor Afrique). In 1998, Burkina Faso laws on telecommunications was passed that led to establishment of a good institutional and legal framework that helped to boost the country's effort to make ICTs available to businesses and individuals in the country (World Bank, 2016). However, the laws are being revised and updated to support ICT and e-Government developments in the country. The country has a Ministry of Digital Economy and Posts (MDENP) that makes sure that ICT Policies are enacted. Also, an independent regulator (ARCEP) and an ICT Agency (ANPTIC) are those that have the mandate of the main ICT projects of the Government. Recent Government administration of Burkina Faso devised a National Plan for Economic and Social Development 2016–2020 (PNDES) to tackle on three main challenges in the ICT access of the country (institutional reforms and modernisation of the administration; development of the human capital; and stimulation of high potential sectors to foster economic development and jobs creation). ICT is part of the PNDES and seen by the government as a key enabler for the country's development (Karakara and Osabuohien, 2019b).

The country adopted, in January 2013, a government's digital development strategy (Cyberstratégie Sectorielle e-Gov - Burkina Faso), that focused on key sectors such as education, health, and rural development (World Bank, 2016). Burkina Faso's ICT sector is characterised by a relatively well performing mobile telephony market but an under-performing internet sector.

Overall, there are 9.4% of internet users in the country, to be compared with the average of 12.8% for the Economic Community of West African States (ECOWAS) sub-region. Most Burkinabe's have internet connection through mobile internet and these are concentrated in the major cities Ouagadougou and Bobo-Dioulasso (World Bank, 2016).

3.2 Ghana

Ghana is one of the West African countries. It is bordered by the Gulf of Guinea in south, Cote d'Ivoire (Ivory Coast) in west, Burkina Faso in north, and Togo in east. Ghana has a land area of 238,533 km². Ghana has 16 administrative regions with Accra as the capital city. The country is captured in pink colour in Figure 1. The official language of the country is English and different indigenous languages are also spoken (with Akan-Twi being the widely spoken). The total population of Ghana as at 26th September, 2010 was 24,658,823 (Ghana Statistical Service, 2012) and current figure is estimated to be 30,417,856 in 2019with GDP of 66.98 billion USD (World Bank, 2020a, 2020b). The real GDP growth is estimated at 6.5% for 2019 (World Bank 2019).

Ghana has made efforts to make ICTs accessible to the citizenry. Ghana developed two (2) key policies for implementation; the ICT for Accelerated Development Policy in 2003 and the National Telecommunications Policy in 2005 to make ICTs accessible to its people. The Ghana ICT for Accelerated Development (ICT4AD) policy captured the ICT vision for the country in the information age. The pillars and thematic areas of the ICT4AD include those of ensuring the deployment and spread of ICTs in communities. In line with this, the ministry of communication formulated the Community Information Centre (CIC) project to serve as community resource centre and tele-centres (Karakara and Osabuohien, 2019b). The CIC provides access to; internet enabled computers, software based on the local information needs, fax machines, printers, telephones, TVs and Radios in communities where it was implemented. This was to create ICT awareness in the rural areas, to disseminate information to rural communities (especially in the areas of health, local governance, environment, and agriculture) and to provide ICT training and capacity building (Government of Ghana, 2003).

Ghana became the second country in SSA to have full internet connectivity in August 1995 (Ngugi *et al*, 2007). Internet penetration in Ghana more than doubled from 172 to 427 users per 10,000 inhabitants from 2004 to 2008 (ITU, 2006) and recent survey indicated that 39.7% of individuals, aged five years and older, know what the internet is, and out of this proportion, 56.6% used the internet (National Communication Authority & Ghana Statistical Service –NCA & GSS, 2020). Mobile phone (92.7%) is the device mostly used to access the internet followed by laptop and desktop computers with tablets being the least use device to access internet. The 2012 RIA Ghana ICT Survey found 8.5% of Ghanaian households have a computer at home. This figure of 8.5% was found to be slightly lower than that of Cameroon (8.6% of households have computers) but considerably higher than that of Tanzania (1.6%). Almost 72% of the households in the 2012 RIA Survey own a radio set with 54% owning a TV set (Research ICT Africa-RIA, 2012). Recent survey by the National Communication Authority and Ghana Statistical Service indicated that 70.1% of households own radios and 68.9% of households own televisions (NCA & GSS, 2020). On mobile phone ownership, 54.1% of individuals aged 5 years and older own a mobile phone. Ownership of mobile phone is highest in the Greater Accra Region (73.7%) and lowest in Upper West Region (36.3%) (NCA & GSS, 2020).

4. Data and Methodology

4.1 Data

This study uses data from the Demographic and Health Survey datasets for Ghana (GDHS VI) for 2014, and Burkina Faso (BFDHS VI) for 2014.These data followed a two-stage sample design. The first stage involved selecting sample points (clusters) consisting of enumeration areas (EAs). The second stage involved a systematic sampling of households. The household listing operation was undertaken in all of the selected Enumeration Area's (EAs) and households to be included in the survey were randomly selected from these lists. In Ghana, about 30 households were selected from each sample point (427 sampling points made up of 216 in urban areas and 211 in rural areas), for a total sample size of 12,831 households. Three questionnaires were used for the 2014 GDHS: the Household Questionnaire, Woman's Questionnaire, and Man's Questionnaire. A total of 12,831 households were selected for the sample. Out of which 12,010 were contacted for the interview with 11,835 being successfully interviewed, yielding a response rate of 99%. With Burkina Faso, 6,448 households were covered.

The data capture whether a household owns a radio, television (TV), mobile phone, computer/tablet, access to the internet as ICTs used by the households. However, internet access and computer/tablet were not captured in the data for Burkina Faso. The ICT variables used (radio, TV, mobile phone, computer/tablet, access to the internet) were coded as dummies of a household having access as equal zero and with no access equal one. For example, if a household has a radio, it is coded zero, and if it has no access, it is given one. Other variables which were coded zero-one are; sex of household head (0=female 1=male), the residence of household (0=rural, 1=urban), marital status of household head (0=not currently married, 1=currently married), wealth status (0=poorest, 1=poorer, 2=middle, 3=richer, 4=richest) and has electricity (0=No, 1=Yes). Continuous variables were; the age of household head, size of household and number of children in the household. These were not coded since they were continuous.

This study uses logistic regression (based on Marginal Effects at Representative values-MER) model, with the dependent variable being access to that ICT equipment (radio, TV, mobile phone, computer/tablet and access to the internet). A separate regression for each of the ICTs in a binary outcome was estimated to investigate, whether the household has access or not. By comparing the two countries, analysis on gender differences in access to those ICTs, the odds of female to male in access, rural/urban differences as well as wealth status and access to ICTs by households were carried out.

4.2 Methodological Approach

In a binary outcome, Let P_i represent the probability of a household having access (to say a computer), and the probability of not having access to a computer is given as 1- P_i. As we do not observe P_i, because Y is a latent variable, but instead we observe the outcome Y=1 if the household has computer and Y=0 if he does not, then we have the following model specification

$$P_r(Y_i = 1) = P_i \qquad (2)$$

$$P_r(Y_i = 0) = 1 - P_i \qquad (3)$$

The probability of a household having a computer is given as:

$$Pi = E(Y = 1|X) = \frac{1}{1 + e^{(\beta_0 + \beta' Xi)}} \qquad (4)$$

Where X is a vector of independent variables, and β is a vector of their respective coefficients. For ease of expression and understanding, equation (4) is simplified as**:**

$$Pi = E(Y = 1|X) = \frac{e^{(\beta_0+\beta' Xi)}}{1 + e^{(\beta_0+\beta' Xi)}} \qquad (5)$$

The probability therefore of a household not having computer can be given as;

$$(1 - Pi) = E(Y = 0|X) = \frac{1}{1 + e^{(\beta_0+\beta' Xi)}} \qquad (6)$$

From equation 5 and 6, P_i ranges from0 to 1 and is non-linearly related not only to the regressors but also to the parameters thereby causing some estimation problems if ordinary least squares (OLS) estimation technique is to be applied. It is possible, however, to reformulate these equations in terms of the odds ratio of the probability of a household having a computer to the probability of the household not having a computer as follows:

$$\left[\frac{Pi}{1 - Pi}\right] = \frac{1 + e^{(\beta_0+\beta' Xi)}}{1 + e^{-(\beta_0+\beta' Xi)}} \qquad (7)$$

$\left[\frac{Pi}{1-Pi}\right]$ is simply the odds ratio in favour of a household having computer and can thus be simplified as follows:

$$\left[\frac{Pi}{1 - Pi}\right] = e^{(\beta_0+\beta' Xi)} \qquad (8)$$

We take natural logarithms of the equation (8) to get our logit model and observe that the log of the odds ratio, L, is not only linear in X, but also in the parameters; *L* is called the logit**,** and hence the name logit model for models like (9).

$$Ln\left[\frac{Pi}{1 - Pi}\right] = Li = \beta_0 + \beta' Xi \qquad (10)$$

Binary logistic regression gives the marginal (thresholds) at which if there is a change in the independent variables (socioeconomic factors) at just a margin, the probability of the dependent variable (ICT adoption) alters. With the Lowess smoothing techniques, it gives at what threshold of the independent variable say age, does the direction of the likelihood of the dependent variable (ICT adoption) changes. For instance, as one ages, the likelihood of adopting radio set increases up to a point, after which an increase in age leads to a decline in the likelihood. This method

helps us understand that the socioeconomic factors influence the adoption of ICTs is not homogenous.

Lowess (locally weighted scatterplot smoothing) is a nonparametric method of local regression method, a local weighted average estimator. It draws the observed pattern in the data to help identify nonlinearities. It provides useful testing for linearity. Lowess carries out a locally weighted regression of the dependent variable on the independent variable, displays the graph, and optionally saves the smoothed variable. The idea is to create a new variable that, for each dependent variable, contains the corresponding smoothed value. The smoothed values are obtained by running a regression using only the data and a few of the data near this point. Lowess can be usefully thought of as a combination of two smoothing concepts: the use of predicted values from regression (rather than means) for imputing a smoothed value and the use of the tricube weighting function (rather than a constant weighting function). Lowess allows us to combine these concepts freely (Cleveland, 1979).

Lowess is a desirable smoother to other smoothing methods like the polynomial smoothing, because of its locality—it tends to follow the data. It also has a smaller bias, which is especially beneficial in estimating m(x) at the endpoints (Cameron & Trivedi, 2005). Lowess regression leads to a much smoother regression function estimate and more precise estimation at the boundaries. We use a bandwidth of 0.8, which means that 80% of the data are used in smoothing each point.We used the following socioeconomic variables; household size, the gender of household head, the age of household head, wealth status, marital status of household head, the household has children below 15 years and residence nature of household (urban/rural).

5. The Empirical Results

5.1 Descriptive Statistics

The data for this study is a household survey data and the descriptive statistics, as shown in Table 1, indicates some level of differences between Burkina Faso and Ghana. On the gender of household head, 87.81% are males in Burkina Faso compared to 67.66% in Ghana. The nature of households' residence shows that in Burkina Faso, the households are predominantly rural, i.e. 79.53% as compared to Ghana of 49.82%. In Burkina Faso, 85.61% are currently married and

living together, while in Ghana, it is 63.04% who are currently married and living together. On wealth status of households, 54.96% are in the middle, richer and richest categories in Burkina Faso and in Ghana the figure is 58.33%.

On access and ownership of ICTs, the data could not capture household access to the internet, and household ownership of computer/tablet for Burkina Faso sampled. In Ghana, only 11.92% has access to the internet on any device and 11.86% owns computer/tablet. Mobile phone ownership shows that 85.32% owns mobile phones in Burkina Faso while in Ghana; it is 82.19% who owns mobile phones. Ownership of radio set shows that 57.26% owns a radio set in Burkina Faso and 66.40% owns radio set in Ghana and ownership of TV shows that only 18.81% of the households in Burkina Faso own TV as against 54.29% who owns TV in Ghana.

Table 1 near here

5.2 ICT Access in Burkinabe and Ghanaian Households

We discuss the results of the regression of marginal effects at the representative value (MER) of the socioeconomic variables that determine the ICT adoption (access and usage) by households in Burkina Faso and Ghana. These are reported in Tables 2 and 3, respectively.

The results indicate that a female-headed household has a reduction in the probability of having access to or owning those ICTs in both countries. A female-headed Burkinabe household has a reduction in the probabilities of owning a radio set by 26%, TV by 4.2% and mobile phone by 5.3% and in a Ghanaian household it reduces the probabilities of owning radio set by 18.4%, TVby 10%, mobile phone by 3.3percent, computer/tablet by 5percent and access to the internet by 4%. This finding s similar to what Gilwald *et al.,* (2010) found that in the rural areas, women are less likely to own mobile phone and Chabossou *et al*., (2009) found that gender (females) and age have little impact on mobile phone adoption in their studies.

Table 2 near here

As the age of a household head increases, it reduces the probabilities of having access or owning such ICTs except for radio set in Ghana. An increase in the age of household head reduces the probabilities of having access to TV by 0.4% and mobile phone by 0.3% in Burkinabe households and 0.12% to have TV and 0.2% to have a mobile phone in Ghanaian households. Perhaps, older people are not so much attuned to technology (ICTs). Chabossou *et al.,* (2009) obtained *a similar finding that* age has little impact on mobile phone adoption in their studies. The age of the household head is positive for having radio set in Ghana, partly because older people in Ghana are noted for loving the use of radio set, especially in the rural areas.

An increase in the size of a household increases the probability of a household having access to ICTs in both countries. If the members in household increases by one, it increases the probabilities of having access to a radio set by 1.4%, TV by 0.7% and mobile phone by 1.5% in Burkinabe households. It increases the probabilities of having radio set by 2%, TV by 2.6%, mobile phone by 2.1%, computer/tablet by 2% and the internet by 1.2% in Ghanaian households. Also, a household staying in a rural area reduces the probabilities of having access to a mobile phone in both countries (with 1.3% in Burkina Faso and 1.4% in Ghana). However, staying in the rural area increases the probabilities of having access to a radio set, TV in both countries. This lends support to the recent findings made by Karakara and Osabuohien (2019b) regarding ICT usage and Bank Patronage.

Table 3 near here

The results further indicate that the household heads that are currently not married have lesser probabilities of having access to a radio set, TV and a mobile phone in both countries. However, being not currently married in Ghana could increase the likelihood of having access to a computer/tablet by 2% and the internet by 2.2%. Also, household heads who have secondary education have an increase in the probability of having access to those ICTs by 4% for a radio set, 1.4% for TV, 2.6% for mobile phone, 7.7% for computer/tablet and 6.2% for access to the internet in Ghana. It means that, as people are more educated, they become more literate and can easily use such technologies. A richer household has an increased probability of having access to those ICTs. In Burkina Faso, a richer household has 15.4% increases in the probability of having

radio set, 31percent increase in the probability of having TV and 6.5% more likely to have a mobile phone. While in Ghana, richer households have 12% more likely to have a radio set, 18.2% more likely to have TV, 10% more chance of having computer/tablet and 8.5% more likely to have access to the internet. It means that a richer household can afford the use and services of these ICTs so they can purchase and use such ICTs. This supports the TAM that analysis factors affecting adoption and intentions (Lee & Jun, 2007) and Yi, Jackson and Probst (2006) summarised that human and social factor play a role in the adoption of technology.

Having access to electricity has a positive impact on access to the ICTs, apart from radio set in Ghana and mobile phone in Burkina Faso. A household being connected to a grid reduces the probability of it having a radio by 1.2% in Ghana but increases the probability of having radio set by 1% in Burkina Faso. This difference could partly be explained by the fact that most radio users are those (particularly rural) households who do not have electricity and can easily use radio with a dry cell as TV cannot be used with dry cells. However, a majority (86.30%) of the households in Burkina Faso are not connected to the grid or have no electricity.

Thus, socioeconomic characteristics matter in influencing households as well as individual's adoption and usage of ICTs. Adoption of ICTs have led to the achievement of financial access by many (Karakara & Osabuohien, 2019b), decreasing rural nature of society (Kayisire & Wei, 2016; Jack & Suri 2011) as many people irrespective of where they reside are still connected and can access necessary information. Age is found to exhibit the trend that, at a certain age, the adoption of radio set declines; however, the rate is different between Burkina Faso and Ghana. It shows that, in the deployment of ICTs, the age structure of the country matters. It has noted that increased technological uptake often shifts inter-generational power dynamics between young people and older. In Malawi, South Africa and Ghana, young people become hubs of knowledge due to their ability to make use of mobile devices and navigate the Internet (Porter *et al.,* 2015).

5.3 Threshold Effects of ICT Usage in Burkinabe and Ghanaian Households

We tested for non-linearity of the age of household head in access to the ICT gadgets studied (radio set, mobile phone, internet access, a television and computer/tablet). The results are captured in the appendix. It shows that as the age of a household head increases, access to a radio

set increases for both countries but to a certain age point. The turning point for household head age in Burkina Faso was estimated to be 41 years of age after which increases in age reduces the probability of access to a radio set while in the case of Ghana it is at age 50 years approximately. On age and adoption of mobile phones, the results show that for both countries, approximately beyond age 30 years, the likelihood of individual adopting mobile phone or TV declines. This finding is so partly because as one gets old, they are not attuned to technology, as Chabossou *et al.*, (2009) and Karakara and Osabuohien (2019b) indicated. However, for access to computer and access to the internet, for the Ghanaian households, beyond age 25 years of age (the threshold age) the individual access to computer or internet reduces. Thus, the threshold age for the adoption of radio in Burkina Faso is 41 years of age and 50 years of age, approximately, in Ghana. For mobile phones and TV, the threshold age for both countries is 30 years of age and for internet access and computer for the Ghanaian sample is approximately 25 years of age.

We also estimated the probabilities of a ten-year increase in the age of household head and having access to ICTs for 30 years to 60 years of age. In Table 4, it shows that as the age of a household head increases by ten years for the period the probabilities of having access to those ICTs reduce except for radio set in Ghana where the probabilities increase. If the age of a household head increases from 30 years of age to 40 years of age in Burkina Faso, it reduces the probability of having access to a radio set by 0.1% while in Ghana it slightly increases by 2.4%. This disparity could be explained anecdotally that older people in Ghana, especially those in a rural household, are noted for loving the use of a radio set.

An important finding is that: for every ten years increase in age of household head for 30 years of age to 60 years of age leads to a constant reduction (2.2%) in the probability of household having access to or owning TV in Ghana. This is also the case for in Burkina Faso where for every ten years increase in age of the household head over 30 years of age to 60 years of age leads to a constant reduction (0.1%) in the probability of household having access to a radio set. It implies that efforts to beef-up usage and access to ICT attention should be concentrated more on the younger ones and as one *ages* concentration on such people should reduce. More so, the younger ones (youth) are swifter in the adoption of new technologies compared to the older ones.

Table 4 near here

The results further underscore that access to the other ICTs such as mobile phone, computers/tablet, and the internet reduces as the age of household head increases by ten years for 30 years of age to 60 years of age. Thus, as the household head grows older, the probability of having access to ICTs reduces for all the ICTs understudy except for radio set in Ghana. Perhaps, older people are not attuned to technology as was the same case observed by Chabossou *et al.,* (2009).

We categorised households into a younger household, middle-aged household and older households based on the age of household head. We used indicators/variables such as the marital status of household head, sex of household head, wealth status of the household, educational level of the household head as well as the age of household head. A younger household (refer to 'A' category) is a household where the household head is aged 25 years who is male with at least primary education and is currently married. The household has a wealth status of being above poorer (i.e., middle status). A middle-aged household (category 'B') is one where the age household head is aged 45 years with all the other indicator/variables being the same as the younger household case apart from age difference. Also, an older household (category 'C') is where the household head is aged 65 years with the other indicators remaining as in the case of younger and middle-aged households. These categorisations helped us to see how access to ICTs differs among such group of households and between these two countries.

In Table 5 it is observed that a younger household in Burkina Faso has about 12% of probability of owning or having access to the TV as against Ghana where such household has 70% likelihood of having access to TV set. With a middle-aged household, access to TV set in Burkina Faso is almost 9% which is a reduction from 12%, and in Ghana, it is 66%, a reduction from 70% and an older household has probability 7% of owning TV set in Burkina Faso and same older household has 62% chance of owning TV set in Ghana.

Again, on access to a radio set, a younger household in Burkina Faso has 64.6% probability of having access, and a middle-aged household has 64.4% chance of owning a radio set. In

comparison, an older household has 64.2% probability. It confirms our earlier observation in Table 4 that as household head ages over 30 years to 60 years' access to radio set reduces at a constant spade. In Ghana, a younger household has 72.3% probability of having access or owning a radio set and a middle-aged has 76.4% probability. In contrast, an older household is 80.1% likely to own radio set, and this is consistent with our earlier finding on Table 4.

Table 5 near here

With access to mobile phones, both younger and middle-aged households in Burkina Faso and Ghana have some probabilities of more than 92% of owning it with older households having a little above 87% chance. It could be partly attributed to the fact that mobile phones are kind of ICT that is widely used by individuals, more modern, can contain a radio app, and contains other benefits like financial services compared other ICTs like radio set and TV set.

A younger household in Ghana has 3% chance of having computer/tablet and 4.5% likely to have access to the internet. For a middle-aged household, it has 2% chance of having access to computer/tablet and 3.5% probability of accessing the internet and with the older household having 1.4% and 2.7% chances of owning computer/tablet and accessing the internet, respectively.

As a way of contributing to theory, this paper looks at the threshold effects of ICT adoption and usage. The paper concludes that the age of an individual (in this case household head) is non-linear to the adoption and usage of a radio set at least at a point when the age reaches 41 years. The likelihood of having access to and watching TV reduces at age 30. Hence, beyond 30 years of age, an individual's likelihood of adopting ICTs reduces for every additional ten years of age. Other studies (Chabossou *et al.,* 2009) have found that older people are not attuned to technologies (ICTs), but could not establish the age threshold. This is the significant contribution of this work by determining the age threshold for adopting ICTs.

6. Conclusion

This study examined households' Information and Communication Technology (ICT) access and usage in Burkina Faso and Ghana as well as the effects of the threshold, which is crucial and topical based on the increasing global usage of ICT. It achieved its objective using a household survey data that was analysed with: descriptive, marginal effects at representative values (MER) regression, and Lowess Smoothing techniques. The following findings, among others, are underscored herein.

In the deployment of ICTs, the age structure of the country matters. It was noted that household access to radio and age of household head have a non-linear relation. As the age of the household head increases the likelihood of a household having radio set increases in both countries up to a certain age point of 41 years in Burkina Faso and approximately 50 years in Ghana and access to radio declines as age increases, this is similar to what Chabossou *et al.*, (2009) observed. Mobile phone was found to be the most ICT tool owned and used by individuals in both countries. It cut across all ages of individuals in both countries as there is a higher probability of household having access to mobile phone whether that household is a younger, middle-aged or older household. Household having access to electricity (from the grid) increases the chances of owning a radio set in Burkina Faso by 1%. However, it somewhat reduces the likelihood of owning a radio set in Ghana by 1.2%. Increase in the size of household increases the likelihood of owning those ICTs in both countries (Karakara & Osabuohien, 2019b). Also, rural households have a slim chance of owning a mobile phone in both countries but a positive chance of having access to the other ICTs.

To conclude, the study has shown that there is the existence of a significant difference in how socioeconomic factors influence access to ICTs (e.g., Mathieson, 1991; Shih & Fang, 2004; Yi *et al.*, 2006) in Burkina Faso and Ghana. The findings are germane as they show how socioeconomic characteristics influence access to ICTs which could help to look at digital divide in the demand side (e.g., Chabossou *et al.*, 2009; Gilwald *et al.*, 2010). The results are essential for IT policymakers and governments of both countries in their bid to making those digital have-nots receive some form ICTs to help in tackling poverty. Thus, policies should be geared towards the provision and accessibility of ICTs to individuals and households, which could lead to a long way in reducing poverty. Also, IT scholars and experts could draw on the findings of this study

and extend the frontiers of knowledge by decomposing this threshold effect into rural-urban differentials and in different ICT equipment.

The findings of this study could be most applicable to Burkina Faso and might not apply to other countries. As a suggestion for further studies, the analysis carried out in this study could be replicated in other African countries especially those with Demographic and Health Survey Datasets with a viewing to complementing and further validating the findings of this study. Studies should also look at datasets that are rich in terms of individuals and households' access to ICTs, including their cost of patronage and preferences of certain ICTs over the other.

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Table 1: Descriptive Statistics of variables

Variable Name	Measurement and Indicator	Response	Burkina Faso		Ghana	
			Percent	Obs.	Percent	Obs.
	Access to Internet	Yes	-	-	11.92	1,410
		No	-	-	88.08	10,416
ICT Access	Owned Mobile Phone	Yes	85.32	5,424	82.19	9,720
		No	14.68	933	17.81	2,106
	Owned computer/tablet	Yes	-	-	11.86	1,403
		No	-	-	88.14	10,423
	Owned radio set	Yes	57.26	3,640	66.40	7,852
		No	42.74	2,717	33.60	3,974
	Owned T.V. set	Yes	18.81	1,196	54.29	6,420
		No	81.19	5,161	45.71	5,406
Sex of Household	Male	Male	87.81	5,582	67.66	8,002
head	Female	Female	12.19	775	32.34	3,834
Residence	Rural	Rural	79.53	5,056	49.82	5,892
	Urban	Urban	20.47	1,301	50.18	5,934
Marital status	Currently Married (CM)	(CM)	85.61	5,442	63.04	7,455
	Not Currently Married (NCM)	(NCM)	14.39	915	36.96	4,371
Wealth status	Poorest	Poorest	23.45	1,491	21.21	2,508
	Poorer	Poorer	21.58	1,372	20.45	2,419
	Middle	Middle	20.12	1,279	21.77	2,575
	Richer	Richer	19.22	1,222	19.33	2,286
	Richest	Richest	15.62	993	17.23	2,038
Has Electricity	Connected to Grid	Yes	13.70	871	71.00	8,396
		No	86.30	5,486	29.00	3,430

Source: Authors' Computation.

Table 2: Marginal effects (MER) from regression of Access to ICTs in Burkina Faso

Explanatory Variables	Has Radio	Has TV	Has Mobile Phone
Sex of Household Head	-0.2588***	-0.0416	-0.0526***
(Female)	(0.0258)	(0.039)	(0.0166)
Age of Household Head	-0.0001	-0.0036***	-0.0031***
	(0.001)	(0.001)	(0.001)
Size of Household	0.0144***	0.0074*	0.0149***
	(0.003)	(0.004)	(0.004)
Residence (Rural)	0.1184***	0.1272***	-0.0135
	(0.023)	(0.028)	(0.016)
Marital Status of Household	-0.0256	-0.1575***	-0.0317**
Head (Not currently	(0.024)	(0.041)	(0.013)
married)			
Wealth Status of Household	0.1539***	0.3086***	0.0646***
(Richer)	(0.007)	(0.024)	(0.015)
Number of Children	-0.00073	0.0091	-0.011**
	(0.01)	(0.012)	(0.005)
Has Electricity (Yes)	0.0096	0.609***	0.0051
	(0.029)	(0.034)	(0.022)
Pseudo R^2	0.1231	0.5073	0.2618
Prob>Chi^2	0.0000	0.0000	0.0000
Log Likelihood	-3805.0197	-1514.4369	-1957.0951
Observations	6357	6357	6357

Note: The standard errors are within brackets; ***, **, and * denote significant at 1, 5 and 10%.
Source: Authors' Computation

Table 3: Marginal effects (MER) from regression of access to ICTs in Ghana

Explanatory Variables	Has Radio	Has Colour TV	Has Mobile Phone	Has Computer / Tablet	Has Access to the internet
Sex of Household Head (Female)	-0.184***	-0.0955***	-0.0330***	-0.0486***	-0.0383***
	(0.012)	(0.011)	(0.006)	(0.007)	(0.007)
Age of Household Head	0.00235***	-0.00123***	-0.00204***	-0.0015***	-0.0011***
	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)
Size of Household	0.0202***	0.026***	0.0208***	0.0181***	0.0123***
	(0.003)	(0.0023)	(0.002)	(0.003)	(0.0023)
Residence (Rural)	0.104***	0.031***	-0.0145**	0.056***	0.0189*
	(0.01)	(0.008)	(0.006)	(0.012)	(0.01)
Educational level household head (secondary)	0.0402***	0.0140***	0.026***	0.077***	0.0616***
	(0.006)	(0.005)	(0.004)	(0.007)	(0.006)
Marital Status of Household Head (Not currently married)	-0.0755***	-0.0583***	-0.0298***	0.0196**	0.0217***
	(0.012)	(0.011)	(0.006)	(0.008)	(0.008)
Wealth Status of Household (Richer)	0.1179***	0.1821***	0.0645***	0.0979***	0.085***
	(0.005)	(0.007)	(0.003)	(0.012)	(0.01)
Number of Children	-0.0334***	-0.0126**	-0.0276***	-0.0384***	-0.0273***
	(0.007)	(0.006)	(0.004)	(0.006)	(0.006)
Has Electricity (Yes)	-0.0124	0.3205***	0.0246***	0.0446**	0.0498***
	(0.012)	(0.02)	(0.005)	(0.018)	(0.017)
Pseudo R^2	0.1073	0.4886	0.2634	0.3577	0.2797
Prob>Chi^2	0.0000	0.0000	0.0000	0.0000	0.0000
Log Likelihood	-6739.64	-4169.8666	-4080.6323	-2766.4486	-3112.6381
Observations	11826	11826	11826	11826	11826

Note: standard errors are within brackets; ***, ** and * denote significant at 1, 5 and 10%.

Source: Authors' Computation

Table 4: Effect of a 10-year increase in the age of Household Head (Burkina Faso-BF & Ghana-GH)

Access to ICT Equipment		30 years	40 years	Change	40 years	50 years	change	50 years	60 years	Change
Access to Radio	BF	0.584	0.583	-0.001	0.583	0.582	-0.001	0.582	0.581	-0.001
	GH	0.653	0.677	0.024	0.677	0.701	0.023	0.701	0.723	0.022
Access to TV	BF	0.078	0.067	-0.011	0.067	0.058	-0.009	0.058	0.05	-0.008
	GH	0.581	0.56	-0.022	0.56	0.537	-0.022	0.537	0.515	-0.022
Access to mobile phone	BF	0.955	0.934	-0.021	0.934	0.904	-0.030	0.904	0.862	-0.042
	GH	0.933	0.914	-0.018	0.914	0.892	-0.023	0.892	0.863	-0.028
Access to computer/tablet	BF	na	na	na	na	na	na	na	na	na
	GH	0.031	0.026	-0.005	0.026	0.021	-0.005	0.021	0.018	-0.004
Access to internet	BF	na	na	na	na	na	na	na	na	na
	GH	0.048	0.043	-0.006	0.043	0.038	-0.005	0.038	0.033	-0.004

Source: Authors' Computation, Note: na = not available

Table 5: Category of household and probability of access to ICTs in Burkina Faso and Ghana

Category of household	Country	Access to Radio	Access to TV	Access to mobile phone	Access to computer /tablet	Access to internet
A	Burkina Faso	0.646	0.116	0.973	na	na
(Younger household)	Ghana	0.723	0.697	0.952	0.029	0.045
B	Burkina Faso	0.644	0.087	0.94	na	na
(Middle-aged household)	Ghana	0.764	0.658	0.921	0.02	0.035
C	Burkina Faso	0.642	0.070	0.872	na	na
(Old aged household)	Ghana	0.801	0.617	0.874	0.014	0.027

Source: Authors' Computation, Note: na = not available

Figure 1: African map showing locations for Burkina Faso and Ghana

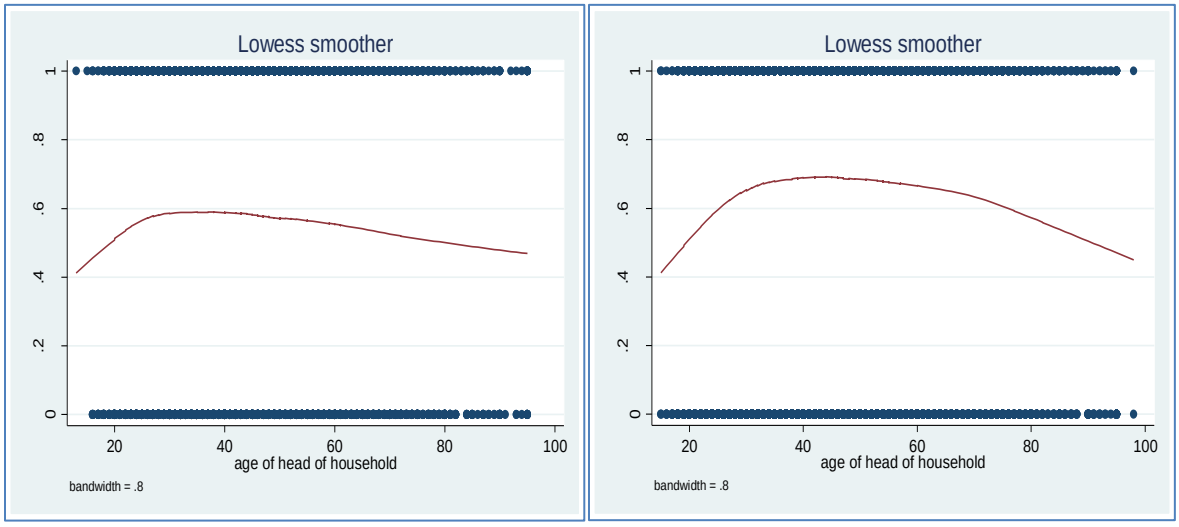
Note: Green is Burkina Faso while pink is Ghana

Source: Google maps, https://www.google.com

Appendix

Turning point of the age of household head and access to Radio

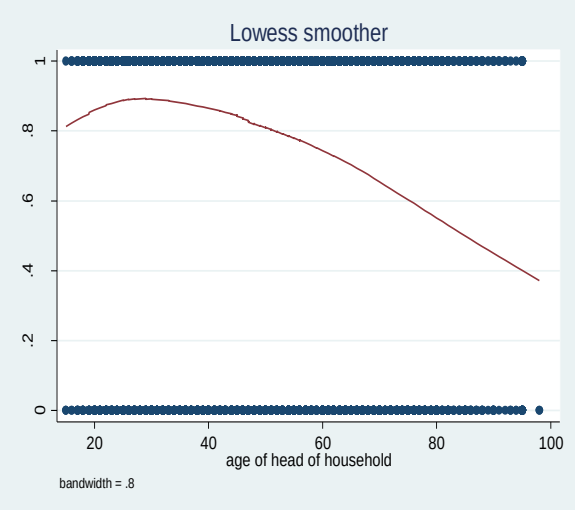
Burkina Faso Ghana



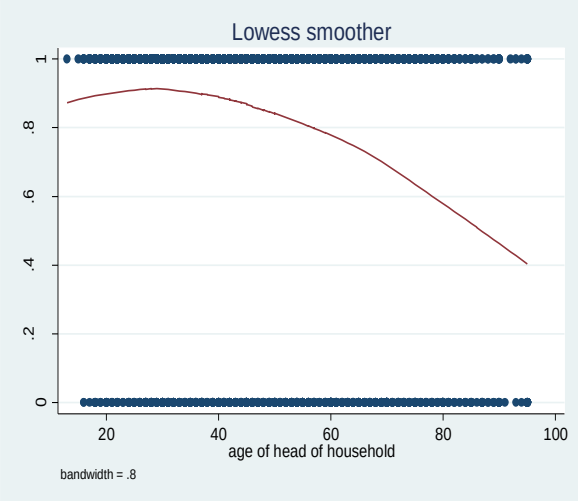
Source: The Authors'

Turning point of the age of household head and access to Mobile Phone or Telephone

Ghana



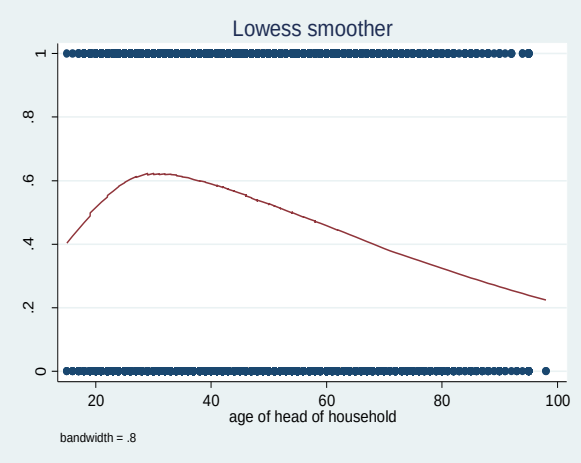
Burkina Faso



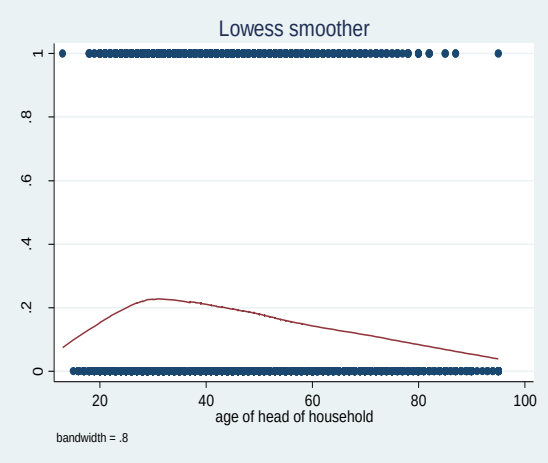
Source: The Authors'

Turning point of the age of household head and access to Television

Ghana



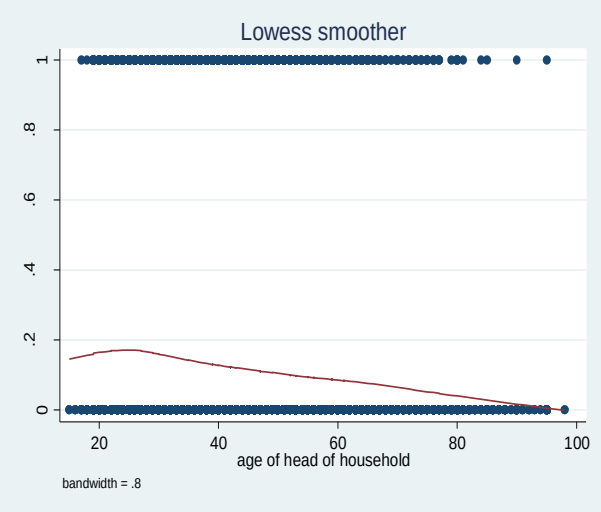
Burkina Faso



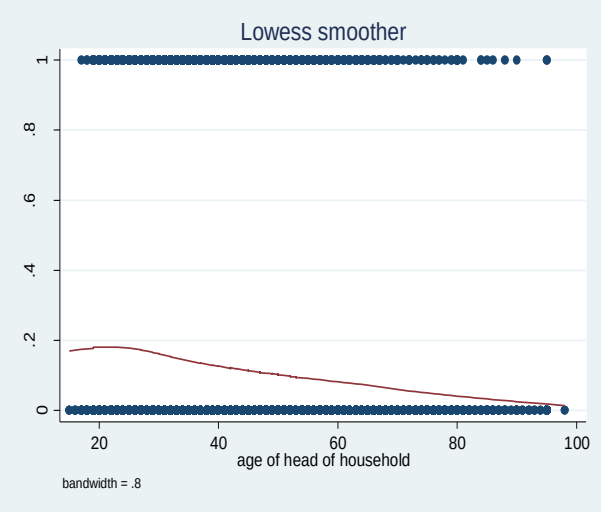
Source: The Authors'

Turning point of the age of household head and access to computer and Internet
(Ghanaian households only)

Internet access



Access to computer or tablet



Source: The Authors'

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